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| electrical field same L12 | 5 |

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## Search History

**DATE: Wednesday, December 24, 2003** Printable Copy Create Case

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L4: Entry 2 of 8 File: USPT Jan 23, 1996

DOCUMENT-IDENTIFIER: US 5486272 A
TITLE: Electroplating method and apparatus

Brief Summary Text (39):
The invention also extends to a method of using an electroplating plant in which feedstock effluent from the plating plant is treated in apparatus in accordance with the present invention, metal used as an electrode in the electroplating plant is recovered at high purity and is re-used in the electroplating plant as electrode material without purification.

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L13: Entry 5 of 5 File: USOC Mar 18, 1947

DOCUMENT-IDENTIFIER: US 2417452 A
TITLE: Electrical system

OCR Scanned Text (5):
ber and spacing to the c6ndenser plates 9 In each of the above- meritioned horizontal sets.. The condenser Plates I 0 are supported on a shaft 12 With their segmental arms in aiignment with each other. As the condenser plates 9 I rotate, these arms alternately are aligried with the condenser plates 9 and then with the , spaces between each pair of condenser plates 0. The shaft 12 is rotatably supported in bearings 10 and 96. The bearing 03 may be supported by'RO being fused into the lower wall of the envelope 0. The bearing 06 is hermetically sealed to the center of a fleieible diaphragm 65 wwch in turn i@ sealed In a central opening in a cap,member 10. This cap member is sealed in the upper end 15 of the envelope 0 and constitutes the upper wall of said envelope. In this woy the envelope 0 is hermetically sealed so that the interior thereof ,may be fllled with a gas, preferabl@ at a high pressure of the order of several atmospheres, to provide a proper dielectric material between the condenser plates 9 and 0 O.' The gas pressure is gufficiently high and the condenser plates 9 and I 0 are spaced 0, sufficient distance from each other so that breakdown of the gaseous medium between the condenser plates 9 and 0 O does not occur at the maximum voltage impres8ed upon the condenser, An auxiliary thrust member 07 is threaded on to the exterior of the cap member 16. The auxiliary member 07 is provided with a central opening in which is joumaled an ad- justing member I 0. The bearing member 14 car- ries the e@.,ternally threaded contact terminal 4. The externally threaded portiori of the contact terminal 4 is received in a threaded opening ex- 3r) tending centrally through the adjusting member 18. Thus, as the adjtisting member 18 is ro- tated the position of the begring .14 is corre- spondingly adjusted so as to maintain a proper pressure on the ends of the shaft. 12. In this way variations which otherwise might occur, due to temperature and external pressure. changes, can be ec)mpensated for. in order to connect the condenser. plates 9 1 In a proper network, each of these Olates is con- nected to the adjacent plate in its horizontal set by an induction coil 19 (Fig. 2). Like*ise each condenser plate 9 is connected to its adjacent vertically aligned condenser plate 9 by an induc- tion coil 20 (Fig. 1). In order to rotate the condenser rotor @the shaft @. 12 carries a magnetic aimatu , ie 2 1, the ends of which are spaced a distance from the low- er inside walls of the envelope 8., Outside of the pe 8 ig disposed a driving magnet 22 having envelo its poles 23 disposed adjacent the @ends of the armature 20. A motor.24 drives the magnet 22 at the desired rotatiorial speed. The motor 24'may be energized by a pair of leads 251 con- nected to a suitable source of current. It will be seen that as the inotor 24 rotates the magnet 22, the magnetile armature 21 wiU likewise be -driven by the ma I gnetic boupling whi6h ekists between it and said magnet. In this -way the shaft 12, carrying the condenser plates I 1, will be rotated. In order to secure a good electrical contact wfth the condenser rotor, the shaft 12 carries a contact ring 26 upon which bears a contact brush 27 supported by and electrically connected to the bearing 14 and its associated contact terminal 4. .Tt Is Intended that the condensbr system shall be discharged at the time when the cbndenser plates I I are aligned With the openings between the condenser plates 9. For this purpose the shaft 1.2 also,

carries a plurality of distributor arms 28 corresponding in number to the number of openlngs between the horizontal condens . er, Plates 9, with each aligned so as to lie between two of the arms of a condenser plate 0 O., A sparkirig electrode 29 is 8upported by a lead-in conductor 3b sealed through the'wall of the envelope 8. The sparking electrode 29 is placed over the center of one of the condenser plates 0 and is located so that the end of each distributor arm 28 passog said sparking electrode 29 with a very smell spacIng therefrom, as the shaft 02 rotates. This spacing is sufficiently close so that the gap between each distributor arm and the sparking electrode 29 breaks down and permits the condenser assembly to discharge each time a distributor arm 28 passes the sparking electrode 29. The lead-in conductor 30 is connected to one of the electrodes of the magnetron'61 for example, itseathodeSO. Aconductor82connectsth6other electrode of the magnetron d, for example Its anode 20, to the contact terminal T. The, operation of the arrangement as described above is substantially as follows. We may. assume that the condenser plates I I and 9 are in alignjnent and that the terminals 3 are energized with voltage of the proper polarit@ so as to supply charging current to the condenser assembly. The voltage of the source may be of a suitabl@ high value, for example, the or r of 3000 volts. Thereupon a charging current will flow through the choke 5 and the rectifier 6 to the condenser assembly. Due to the action of'the choke 5 in storing energy in its, magnetic fleld during the building up of the charging current and delivering said energy to the condenser during the decay of the charging current, the condenser assembly will be charged substantially to double the voltage of the source, for example, to a voltage of the order of 6000 volts. As the charging current falls to zero, the rectifler tube 6 stops conductinig current and therefore disconnects the condenser from the charging system until said condeiiser is subsequently discharged. The time constan@-of the charging system is such that the above described charging is completed when the condenser plates I I and 9 are substantially in allgnment with each other. When the condenser Plates I I niove away from the condenser plates 9 to a position of alignment with the openings between said condenser plates@ 9, work is done against the force of the electrical field existing between the plate@ I I and 9, which force tends to move said pliites toward each other. The work thus d6ne @manifests Itself as an increase in the voltage on the condenser and'- a corresponding Increase in the energy stored therein. The nature of the above increase will be more clearly understood f.rom the following considerations. Separating the plates of a condenser decreases the capacity of the condenser oropor. I tionately to the separation. . Th e voltage E across a capacity, C c6,n be expressed as E=Q c where Q Is the quantity of electricity stored In the capacity. Since separating the plates (f a condenser does not change the quantity of electricity stored therein it wtH be seen that the voltag6 across the c-ond-enser increases proportionately as the capacity decreases. The energy W-stored in a condenser can be'expressed as W= CE2 2

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L13: Entry 2 of 5 File: USOC Oct 4, 1966

DOCUMENT-IDENTIFIER: US 3277267 A
TITLE: Method and apparatus for treating electrically conductive surfaces

OCR Scanned Text (9):
7 piece 22 may be mounted on a milling machine permitting it to be automatically moved forwardly at a constant rate of speed. Because the mounting means described above constantly urges the electrode 20 against the workpiece surface 24, the electrode will automatically fOllOw the surface even if it is irregular or curved. This eliminates the need for special skill in operation, in -order to make continual,adjustment,of electrode position, and thus makes automatic operation practicable. This mode of operation provides cons-istent carbide coatings of high quality (although a number of modifications and iml@rovements over it may also be provided, as indicated below). I prefer to employ an electrode 20 comprising carbide rnaterial because of its hard- surfacing and wear-resistant properties when depo i@ted on the workpiece surface. However, materials such as silver, brass, or other corrosion-resistant metals may also be applied to the workpiece surface where desired. Carbon electrodes may be used where heat treatment of the workpiece surface is desired, preferably in conjunction with rotational and vibrational motion of the electrode. The carbon electrode is rapidly consumed when rotational motion alone is employed, due to the roughened workpiece surface created by the electrical discharges. Vibration will reduce the rate of such electrode consumption and will interrupt the low-resistance current flow, thereby intensifying the electrical discharges. I have found that the contacting pressure must not be excessively great, since this suppresses high intensity electrical dischar,-es and tends to remove metal from the surface, particularly where the electrode is rotated at high speeds. At any given instant, luminous discharges occur between the electrode 20 and the workpiece surface 24 substantially along the line of contact therebetween. Each of these discharges occurs upon contact between microscopic points on the electrode and workpiece surface. Due to the extremely small area through which each such discharge occurs, each discharge is of extremely high intensity thereby producing extremely high temperatures exoeeding the melting temperatures of both the electrode and the workpiece material. Upon discharge therefore, the workpiece material and the material being deposited are fused. (Alternati@vely, the inethod may be employed to raise only the temperature of the workpiece above its melting point, thereby producing heat treatment of the workpiece surface rather than carbide depositing.) The electric discharges between microscopic contacting regions on the electrode and workpiece material are produced by the short duration pulses of electrical energy resulting As the electrode from discharge of the capacitor 32. rotates, the liquified contacting regions are separated by the sliding or wiping motion of the electrode, thus instantaneously breaking the short circuit existing therebetween and leaving electrode material deposited upon the workpiece- surface. As each minute point of contact between the electrode and the workpiece is lost, either through dissipation of the contacting material as a result of the intense electrical discbarge or through motion of the electrode apparently- sufficient resistance is created between the electrode and the workpiece surface to enable recharge of the condenser until the next contact discharge of the electrode with a point on the workpiece surface. With the capacitor 32 discharged, the electrical field between the workpiece and the departing line of contact has decayed sufficiently to prevent arcing across any existing gap. Thus, the next electrical discharge will occur between the workpiece

surface 24 and a different poin-t or line of contact on the electrode 20. Of course, the slow relative translatory motion or feed of the workpiece with respect to the axis of the electrode causes the line or point of contact upon the workpiece surface 24 to be advanced. Hence there is no overheating and the entire surface can be coated. 3,277,267 8 I have utilized capacitors having capacitances in. the range of about 1-150 microfarads and a variable resistor in the range of 8-70 ohms under varying sets of condi-I tions and have obtained satisfactory results. Other types of circuit systems providing electrical, magnetic, chemical, mechanical or other means of rapidly depriving the electrode of sufficient voltage to prevent drawing out of the arc may alternatively be used, some of these systems being described in greater detail below. It may be noted, however, that capacitors serve the funtion not. only of inhibiting arcing but also of storing energy in the circuit, thereby permitting a small power supply system to deliver intense instantaneous bursts of energy. Preferably, the electrical system will provide both of these features, which may be referred to as "having the characteristics of condenser discharge,"- namely-(I) depletion of voltage below the arcing voltage upon and immediately following discharge and (2) storage of energy, permitting the discharge of instantaneous intensified bursts of energy at the region of contact. The voltage supply should be well below the spark breakdown voltage (which is about 2,000 volts for one millimeter air gap), and should be sufficient to provide a heating,cuffent upon contact (preferably not less than about 20-40 volts). I prefer to use a D.C. voltage with the electrode being the positively-charged terminal. An advanta.-e of this polarity is that more heat is normally generated in the positive electrode than in the negative workpiece, thereby helping in the transfer of material from the electrode to the workpiece. However, under some conditions, I may reverse the polarity depending on the materials involved and the details of operation to be performed. For example, if higher temperature at the workpiece surface is desired, or if carbide powder is employed in the region of the electrode contact, a negatively charged electrode may be desiable. I may also reverse the polarity in some cases where it is desired to decrease or "undercut" the workpiece surface dimension by removing a thin layer of material from, it. By appropriate adjustments of the electrical circuit, and by varying the speed of the elect@rode, I have found it possible, while surfacing a workpiece, with either polarity, to build up its surfacei maint@ain its dimensions constant, or decrease it. Thus, I am able not only to hard- surface a workpiece, but also to correct- the dimensions at the same time, if desired. For purposes of exemplification, the "condenser discharge" circuit employed in FIGURE I may utilize the following voltage, resistance and capacitor settings: for scribed), with a 60-volt D.C. power source, 18 micro- an initial or "rough" coat (as hereinafter further de- farads capacitance, 8 ohms resistance, th-@ peak current will be 70-80 amps. with a pulse width of 35-40 microseconds; for a final or "finish" coating (also as herein- after further described), with the capacitance reduced to 4 microfarads and the resistance increased to 16 <)hms, the peak current will be 40-50 amps with a pulse width of 17-20 micro-seconds. Referring again to FIGURE 1, I have also provided a separately-wired variable speed motor 54 rotatably driving a substantially horizontal shaft 56 An offset weight 58 is eccentrically mounted for rotat'ion with shaft 56. As the weight 58 is rotated, it tends to cause an oscillatory upward and downward force between the elect-rode 20 and the workpiece 22, thereby causing a vibratory action of the electrode 20. An advantage of adding this vibratory action to the rotational action of a circular electrode is that it peri-odically insures the breaking of electrical contact in the event that the area of contact is excessive or some particle or mass of material has caused a lowresistance current flow between the electrode 20 and the workpiece 22 which will prevent full rechargin- - of the condenser and therefore reduce the intensity of the electrical discharge. In addition, the impagt or pressing action which results tends to increase the depth of pene.